National Library of Medicine

FOUNDED 1836

Bethesda, Md.

U. S. Department of Health, Education, and Welfare

PUBLIC HEALTH SERVICE

NATIONAL LIBRARY OF MEDICINE

MEDLARS CLASSIFICATION of STEROIDS

MEDLARS CLASSIFICATION of STEROIDS

Prepared by

Elizabeth J. Van Lenten, Ph.D.

Index Section

Bibliographic Services Division

National Library of Medicine

Arch.
WK
15
V259m
1968
c.2

National Library of Medicine
Bethesda, Md.

QS 21 N68

MEDLARS CLASSIFICATION OF STEROIDS

This report will be concerned with MEDLARS policies on indexing steroids and the terminology of Medical Subject Headings (MeSH) which are available at present (1968 MeSH). As much as possible, definitions of general terms and specific compounds will be provided. These are intended to be of use to indexers, searchers and the user of Index Medicus who is concerned with the role of steroids in medicine and medical research.

If the journal article supplies the information, every steroid will be classified for Index Medicus from two viewpoints, chemical and physiological or pharmacological. Thus classification terms are found in the MeSH categorized list, section D2, organic chemicals and structural groups, and in several of the other sub-categories of section D depending on their pharmacological or physiological roles. MeSH terms will generally be indicated by capital letters as they are introduced and defined.

Steroid Chemistry

Steroids are a class of compounds including the sex hormones, the non-sugar portion of cardiac glycosides, bile acids, vitamin D, toad poisons and saponins. They are considered to be any compounds having a cyclopentano-perhydrophenanthrene ring system as shown in Figure 1. The rings are labeled as indicated, with cyclopentane (ring D) fused to a phenanthrene ring system (A, B, and C) in which all the carbons have their maximum quota of hydrogens.

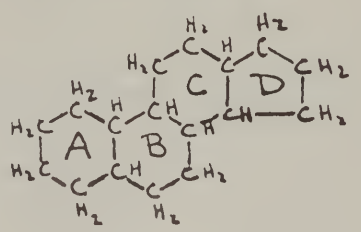
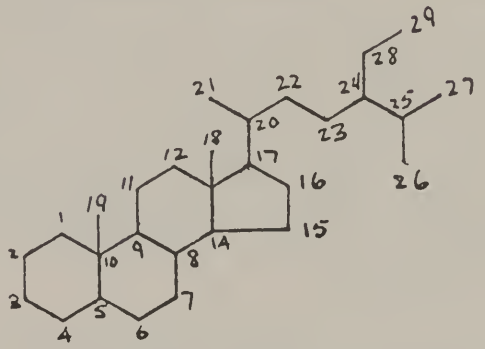


Figure 1

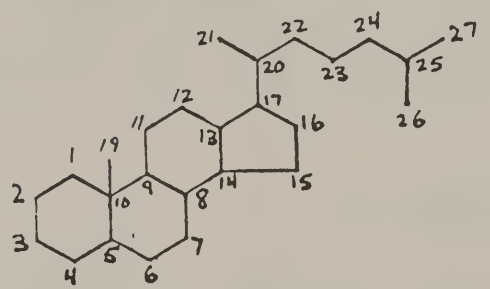
Substituents in this nucleus and on the commonly occurring side chains are located by a standard numbering system as shown in Figure 2. In this

Figure 2



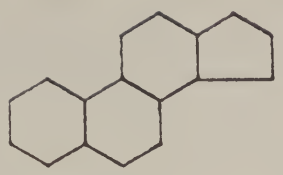
shorthand notation, the individual carbon atoms are not shown, but each numbered position represents a carbon or a specific substituent. If one or more of the possible carbon atoms are not present, the numbering of the remainder of the structure is not changed. Thus, (Figure 3) if there were

Figure 3

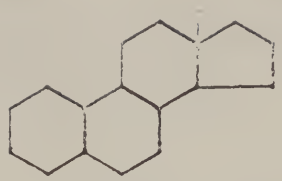


no methyl carbon (number 18) attached at position 13, a carbon attached to position 10 would still be number 19 and the side chain attached to carbon 17 would be numbered from C-20 on up.

There are six main classes of what may be termed the parent steroid hydrocarbons. When considered in the order of increasing complexity of substituents on the cyclopentano-perhydrophenanthrene ring system they are GONANES, ESTRANES, ANDROSTANES, PREGNANES, CHOLANES, and CHOLESTANES (see Figure 4). Although the structures are illustrated with fully saturated (i.e. hydrogenated) rings, certain modifications are allowed within each of these classes of steroids.

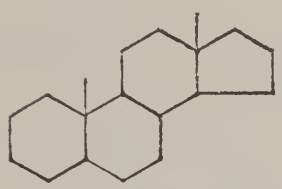


GONANE

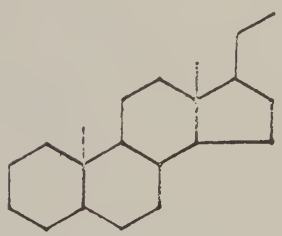


ESTRANE

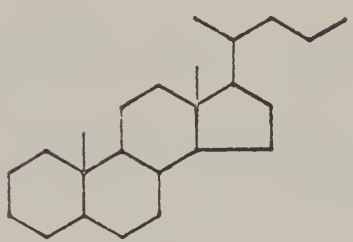
Figure 4



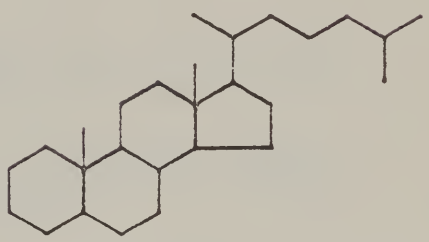
ANDROSTANE



PREGNANE



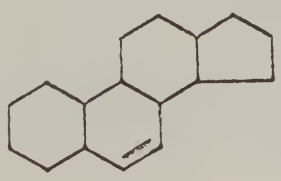
CHOLANE



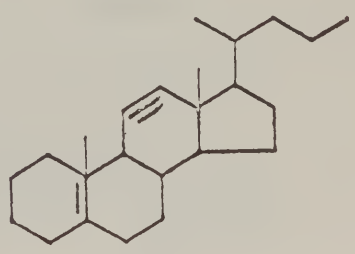
CHOLESTANE

These include (1) any degree of hydrogenation (Figure 5) thus making possible the introduction of double or triple bonds within the rings; (2) hetero-

Figure 5



GONANE



CHOLANE

substitution in any of the rings, the most common examples of which will tend to be replacement of a ring carbon by nitrogen, oxygen or sulfur (Fig-

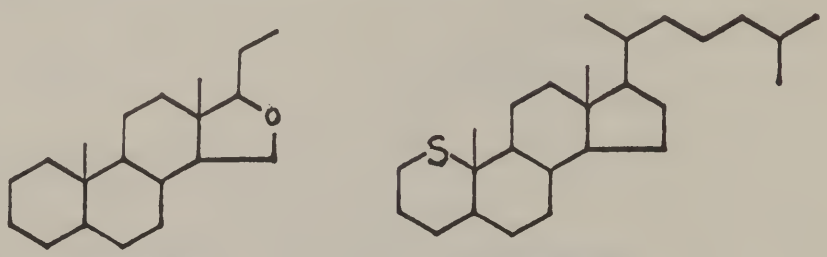
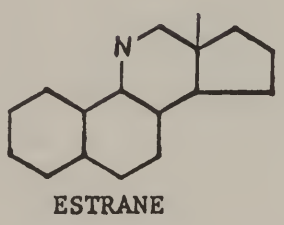


Figure 6



ure 6); (3) any other carbon or non-carbon derivatives except as specified in the class definition.

Gonane (Figure 7) is the parent steroid compound without any methyl groups attached to the ring.

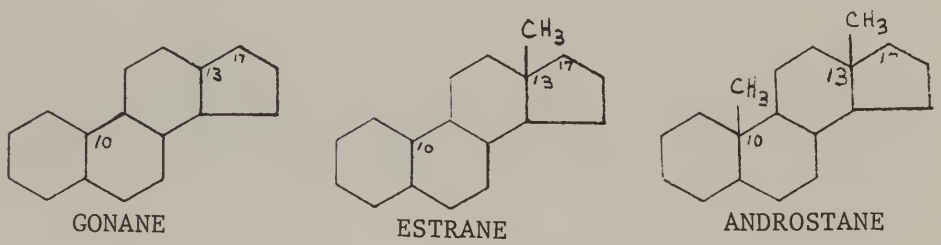
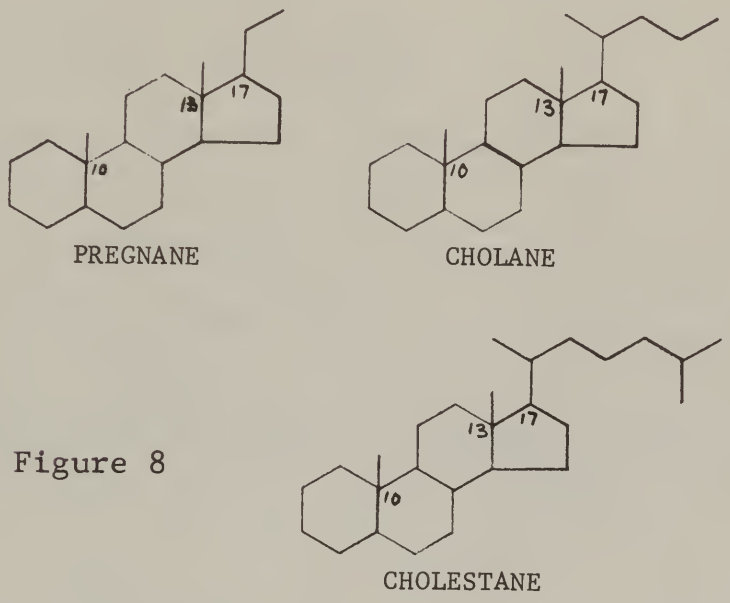


Figure 7

It is modified by the introduction of methyl groups at C-13, and C-13 and C-10 to give, respectively, estrane and androstane. These three class terms are

also applicable to the corresponding compounds with a single carbon at C-17. Pictures of the structural formulae may frequently omit the $-CH_3$ groups at C-10 and C-13, and indicate their presence by single straight lines in the appropriate positions.

The three more complex steroid hydrocarbon classes retain the methyl groups at carbons 10 and 13,



PREGNANE CHOLANE

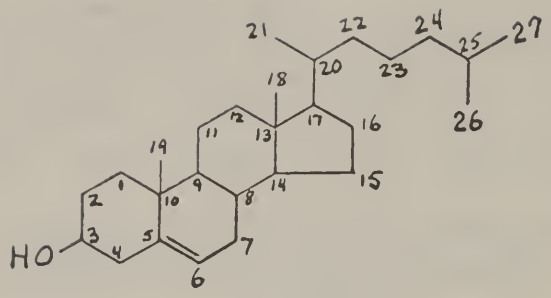
CHOLESTANE

Figure 8

(Figure 8) and have side chains of increasing lengths at carbon 17. Thus, pregnane has a two-carbon side chain, cholane has a branched five-carbon chain, and cholestane has a doubly-branched eight-carbon side chain.

When one or more hydroxyl groups are introduced as substituents on the steroid rings or side chains, the class of compounds is called STEROLS (D11). The most common example is CHOLESTEROL, seen in Figure 9. It provides an example of the systematic

Figure 9

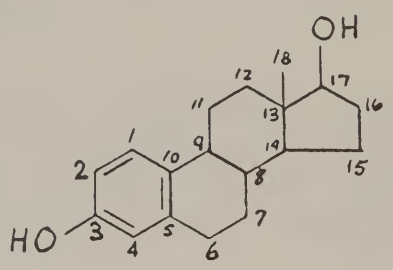


CHOLESTEROL

CHOLEST-5-EN-3 BETA-OL

naming of steroid compounds. The basic structure is that of a cholestane, with one unsaturated double bond between carbons 5 and 6, and an alcoholic (i.e. hydroxyl) group at position 3. Thus it can be called cholest-5-en-3 beta-ol, with the root "cholest" from cholestane, "en" for the double bond and "ol" for the alcohol side chain. In this case the double bond is between two carbon atoms which are numbered sequentially (5 and 6). It is also possible to have a double bond between carbons 5 and 10 as may be seen in Figure 10 for ESTRADIOL. In this case the systematic

Figure 10



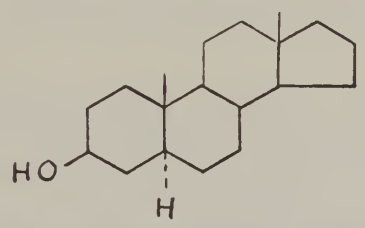
ESTRADIOL

ESTRA-1,3,5(10)-TRIEN-3,17 BETA-DIOL

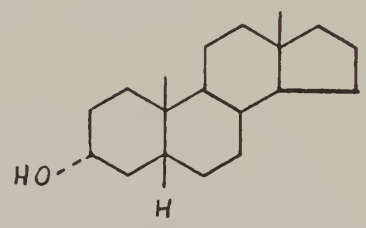
nomenclature indicates that the compound is an estrane with three double bonds and two hydroxyl groups, and the parentheses show that one double

bond is between C-5 and C-10. In the absence of any indication to the contrary, the double bonds at carbons 1 and 3 are connected to the next higher numbered carbons, in this case 2 and 4, respectively.

For both cholesterol and estradiol, one of the hydroxyl groups was designated "beta". This refers to the stereochemistry of the steroid molecule. Any substituent attached to a ring carbon may be above or below the plane of the ring structure. Substituents below the plane of the rings are designated alpha and symbolized by a dotted line, while those above the plane are shown as solid lines and called beta (Figure 11). This nomen-



5 ALPHA-ANDROSTAN-3 BETA-OL



5 BETA-ANDROSTAN-3 ALPHA-OL

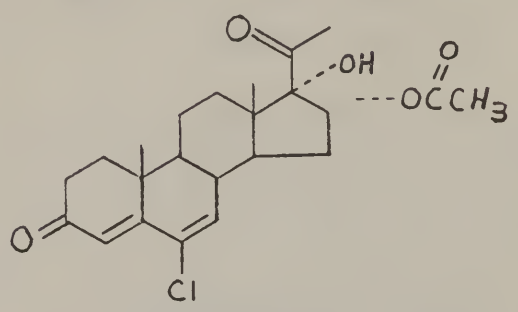
Figure 11

clature is also used for the position of the hydrogen atoms attached to the rings, particularly the one at C-5. Thus 5 alpha-androstane is androstane in which the hydrogen is below the plane of the rings. In general, no distinction is made between alpha and beta isomers in indexing with MeSH terminology. If the author of an article makes a point of the difference between alpha and beta substituents, then the provisional heading STEREOISOMERS would be used.

Frequently steroid alcohols are administered or isolated from organisms as esters. The MeSH term is used to refer to either the free alcohol

or its ester. For instance the compound CHLORMADINONE shown in Figure 12 may be found as either

Figure 12



CHLORMADINONE

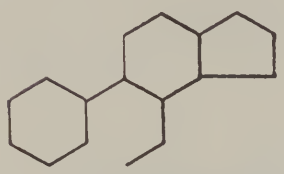
6-CHLORO-6-DEHYDRO-17 ALPHA-ACETOXYPROGESTERONE

6-CHLORO-17-HYDROXYPREGNA-4,6-DIENE-3,20-DIONE

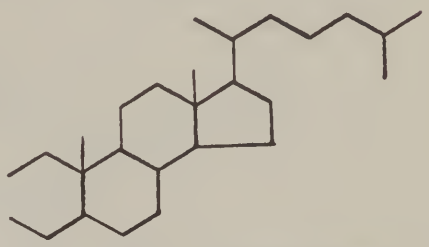
the 17-alcohol or 17-acetate. This is an example also of the variety of systematic names which can be used to refer to any one compound, since it has been referred to by different authors either as a progesterone derivative, or as the derivative of the basic ring structure, which is pregnane. Index Medicus policy, as I have mentioned already, is to use only the class terms given in category D2, if the specific compound is not a MeSH term.

Most of the steroids encountered in the medical literature can be classified chemically either by a specific MeSH term, such as those already cited, cholesterol, estradiol and chlormadinone; or else by their membership in the six basic structural classes, gonanes, estranes, androstanes, pregnanes, cholanes and cholestanes, with the addition of the term sterols if an alcohol or an esterified alcohol is present. The physiological and pharmacological aspects of classification will be considered in a later section.

In addition to these basic chemical structures, various other modifications within the four rings are found in certain special classes of steroids. Most of these are also available as MeSH category D2 headings. Compounds in which one of the rings has undergone fission are called SECOSTEROIDS (Figure 13). The systematic name indicates the pos-



5,6-SECOGONANE

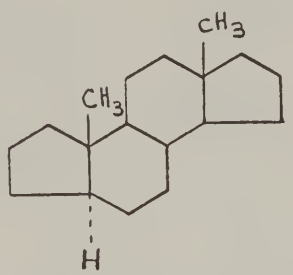


2,3-SECOCHOLESTANE

Figure 13

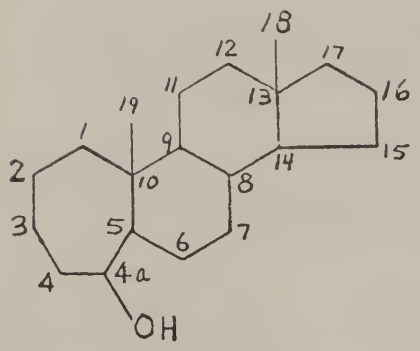
ition of the cleavage, as in this figure where we have 5,6-secogonane and 2,3-secocholestane, with the bond cleavages in rings B and A, respectively. The NORSTEROIDS include any compounds in which a ring contraction, that is, elimination of a $-CH_2-$ group, has taken place, as shown in Figure 14.

Figure 14

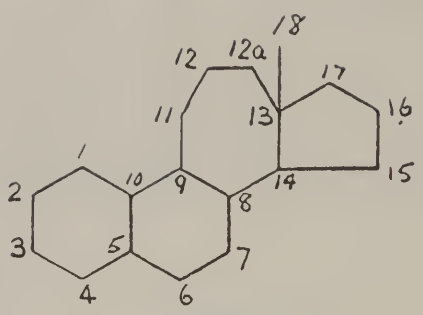


A-NOR-5 ALPHA-ANDROSTANE

The compound in Figure 14 is A-nor-5 alpha-androstane. Ring expansion occurs in the HOMOSTEROIDS (Figure 15) and the extra carbon atom or atoms



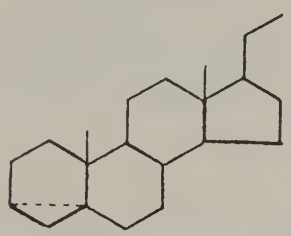
A-HOMOANDROSTAN-4a BETA-OL



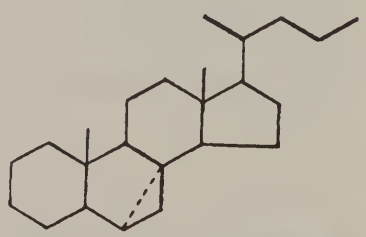
C-HOMOESTRANE

Figure 15

are labeled a,b, etc., with the highest numbered carbon which is exclusively within the expanded ring, giving for example, A-homoandrostan-4a beta-ol and C-homoestrane in Figure 15. When the size of the rings is unchanged, but a three-membered ring is introduced within the parent ring, the compound is a CYCLOSTEROID (Figure 16). The



3 ALPHA,5-CYCLOPREGNANE



6 ALPHA,8-CYCLOCHOLANE

Figure 16

systematic name indicates the position of the bond within the steroid nucleus as 3 alpha,5-cyclo-pregnane and 6 alpha,8-cyclocholane.

Certain naturally occurring steroids have been formed by the addition of a lactone ring to the four-ring parent system. These include members of the digitalis

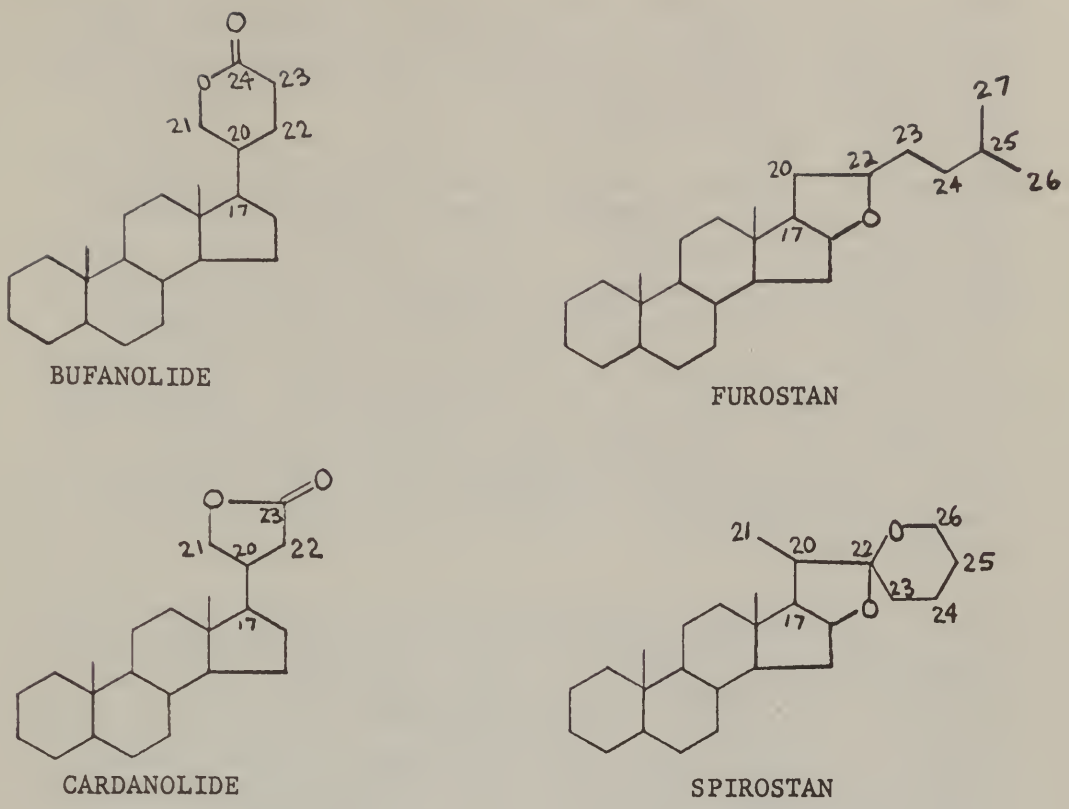


Figure 17

glycosides with a five-membered lactone at C-17 which are known as CARDANOLIDES and the squill toad poisons with a six-membered lactone at C-17 (BUFANOLIDES). SPIROSTANS and FUROSTANS both have cyclic five-membered ethers fused to ring D, with respectively a six-membered cyclic ether or an isopentane chain attached at C-22 (Figure 17).

Physiology and Pharmacology of Steroid Hormones

Once a steroid compound has been identified by the most specific chemical term or terms available in MeSH it should also be indexed with respect to where it comes from in the body and what it does

if these factors are pertinent. These aspects are covered for steroid hormones in category D8, and a few other types of steroids are found in categories D11, D7, D6, D5 and D3.

The physiological source terms available in D8 are ADRENAL CORTEX HORMONES, CORPUS LUTEUM HORMONES, and PLACENTAL HORMONES. All of these have a number of specific steroids indented under them in the categorized list, which would be used preferentially if the author refers to them. However, a very general article, or one in which a great many steroids are discussed, might use the general term as the printed Index Medicus term (IM) and the specifics for computer storage and search retrieval (NIM) only.

Due to variations in biosynthetic capabilities of these organs a number of compounds, such as progesterone, are listed only under one MeSH term for source, although they are actually produced at more than one site. The classification in the categorized lists will usually indicate the most important physiological source, but the definitions given in the appendix to this report and appearing in the indexing authority file will give the alternate sources just for the sake of completeness. Thus the categorized list gives only one specific hormone, GONADOTROPINS, CHORIONIC, indented under PLACENTAL HORMONES, although during the last two trimesters of pregnancy the placenta is also an important source of estrogens and progesterone. It will be noted that some of these variations are due to sexual differences in the relative significance of substances such as androgens or estrogens.

In addition to anatomical sources, category D8 also subdivides the steroid hormones on the basis of their physiological and pharmacological roles.

The adrenal cortex hormones, in addition to quite small amounts of androgens, estrogens and progesterone, include the GLUCOCORTICOIDS and MINERALOCORTICOIDS, which are distinguished by their influence on carbohydrate and electrolyte metabolism in the organism, as well as by general differences in their chemical structures.

Figure 18 shows the most important glucocorticoid, hydrocortisone, and a mineralocorticoid, desoxy-

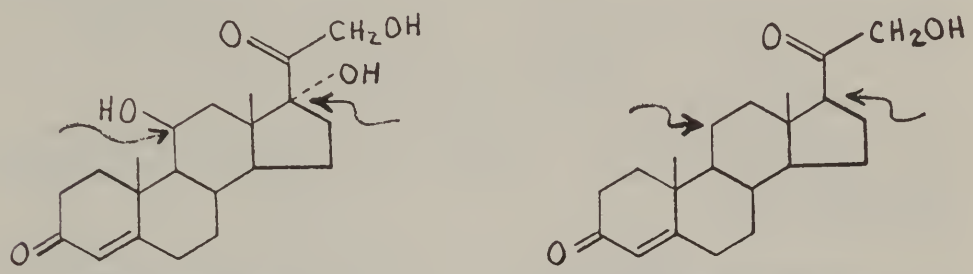


Figure 18

corticosterone, with the chemical hallmark of each class emphasized. The glucocorticoids have oxygen atoms, either in the form of hydroxyl or keto groups, at carbons 11 and 17, while the mineralocorticoids are generally members of the 11-desoxy series. The physiological roles of enhancement of carbohydrate metabolism by glucocorticoids, and of electrolyte balance by mineralocorticoids, are more important than the chemical structures, since the most important mineralocorticoid in the body, aldosterone (Figure 19) does

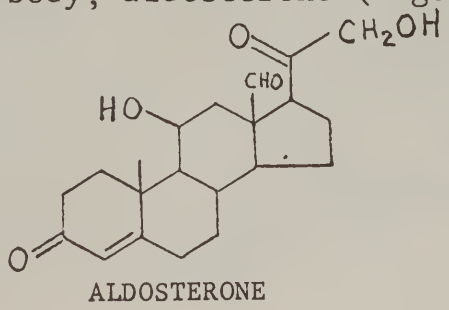


Figure 19

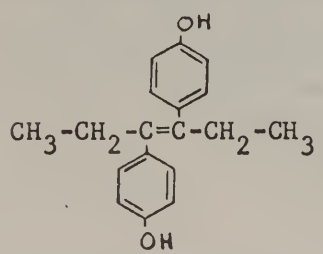
have a hydroxyl group at C-11.

The list of specific glucocorticoids includes some compounds which may not be found naturally in the body, but which have been found to have the same pharmacological role as the endogenous substances.

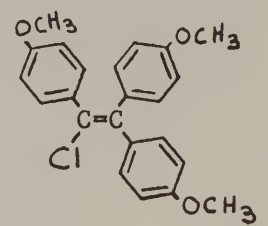
ANDROGENS and ESTROGENS are grouped together as the SEX HORMONES, which refer to substances influencing the development and function of sexual organs and secondary sexual characteristics. The ANDROGENS perform these functions in the male, ESTROGENS in the female. Certain androgenic substances have relatively fewer masculinizing effects and are more important in their influence in promoting general body growth. These are known as ANABOLIC STEROIDS.

In addition to the role of estrogens in promoting female sexual development, the PROGESTATIONAL HORMONES are important for the maintenance of pregnancy and preparation of the mammary glands for lactation.

It is possible to find compounds with all the pharmacological functions of an estrogen or an androgen, but which are completely unrelated structurally to the steroids. For example the estrogens, DIETHYLSTILBESTROL and CHLOROTRIANISENE are shown in Figure 20.



DIETHYLSTILBESTROL

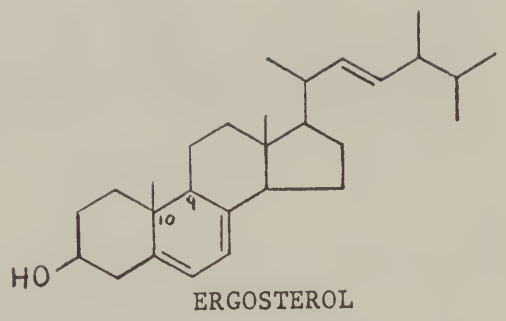


CHLOROTRIANISENE

Figure 20

Other Steroid Compounds

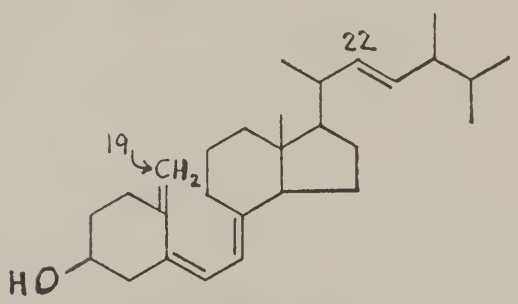
In addition to hormones, a number of other natural products possess the cyclopentano-perhydrophenanthrene ring nucleus. They include vitamin D, the bile acids and their salts, various cardiac glycosides and some alkaloids.



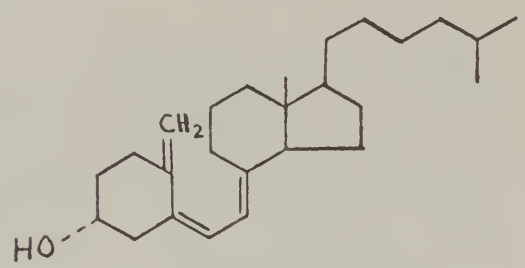
ERGOSTEROL

Figure 21

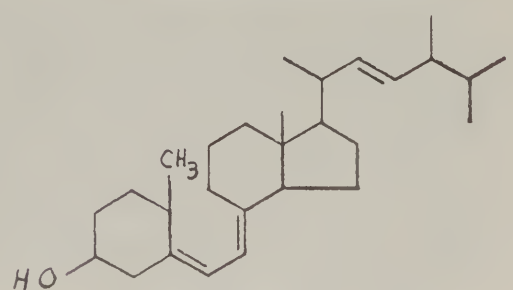
The D vitamins are formed by irradiation of ergosterol (Figure 21) usually producing a break in ring B between carbon atoms 9 and 10. As was mentioned earlier, such a fission of the ring structure produces a secosteroid. Ergosterol itself is indexed as VITAMIN D, and three specific D vitamins are also currently available as MeSH terms. They are ERGOCALCIFEROL, or vitamin D_2, CHOLECALCIFEROL, which is vitamin D_3 and DIHYDROTACHYSTEROL. In Figure 22 it can be seen that they differ only by the presence or absence of a double bond between C-10 and C-19, and at C-22.



ERGOCALCIFEROL



CHOLECALCIFEROL

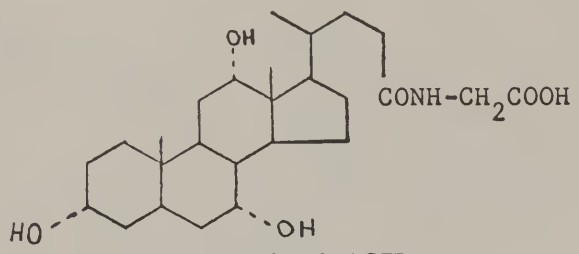


DIHYDROTACHYSTEROL

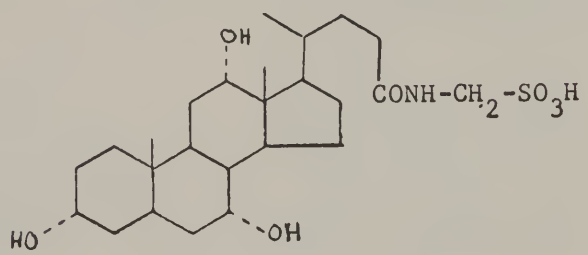
Figure 22

The BILE ACIDS AND SALTS are sterols of the cholane class, that is, they have a branched five-carbon chain at C-17. They are frequently encountered in a form esterified with glycine or taurine, for instance in Figure 23 as glycocholic acid and

Figure 23



GLYCOCHOLIC ACID



TAUROCHOLIC ACID

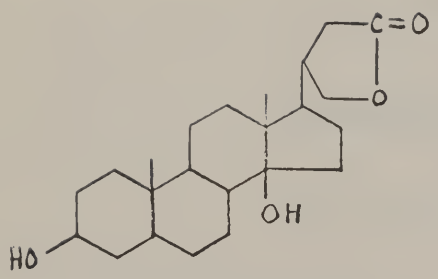
taurocholic acid. The bile acids and their salts aid in the digestion of triglycerides, by converting them to a more soluble form. In addition, administration of the purified chemical compounds will stimulate the formation and release of bile by the liver.

A group of steroids of great therapeutic importance is the CARDIAC GLYCOSIDES. These plant derivatives, which act by the stimulation of the action of heart muscle, are composed of cardanolide or bufanolide sterols linked to a sugar side chain. A number of these use as the MeSH heading the name of the plant from which they are derived (Table 1) while for others the drug itself has been well characterized, or, as in the case of strophanthin, comes from a

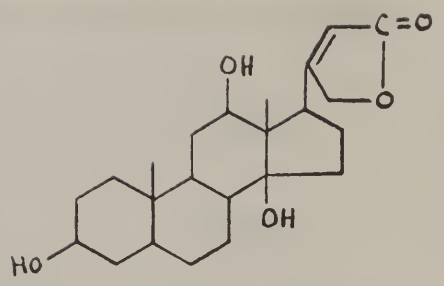
Table 1: CARDIAC GLYCOSIDES (D5, D11)

PLANT	GLYCOSIDE
ADONIS	adonitoxin
CONVALLARIA (lily of the valley)	convallatoxin
OLEANDER	oleandrin
Strophanthus gratus	OUABAIN
SQUILL	scillaren
dogbane family	STROPHANTHIN
DIGITALIS (foxglove)	DIGITALIS GLYCOSIDES DIGITOXIN DIGOXIN LANATOSIDES

number of different plant genera. Perhaps the best known cardiac glycosides are those derived from various types of foxglove, the DIGITALIS GLYCOSIDES. The LANATOSIDES are isolated from the leaves of Digitalis lanata, and are all composed of the same sugar residue, digitoxose, coupled with different cardanolide sterols at the C-3 hydroxyl group. Two of these glycosides are available as MeSH headings, DIGITOXIN and DIGOXIN (Figure 24).

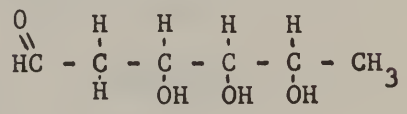


DIGITOXIGENIN,
THE AGLYCONE OF DIGITOXIN



DIGOXIGENIN,
THE AGLYCONE OF DIGOXIN

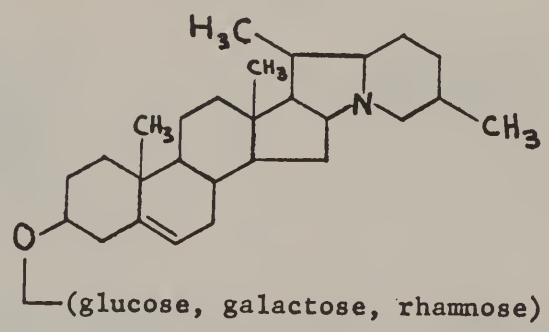
Figure 24



DIGITOXOSE

A few alkaloids are composed of compounds related to the steroids. These include the saponin SOLANINE, a glycoside from potatoes and tomatoes, whose aglycone, solanidine, may be considered to be a cholestane derivative (Figure 25) since the

Figure 25



SOLANINE

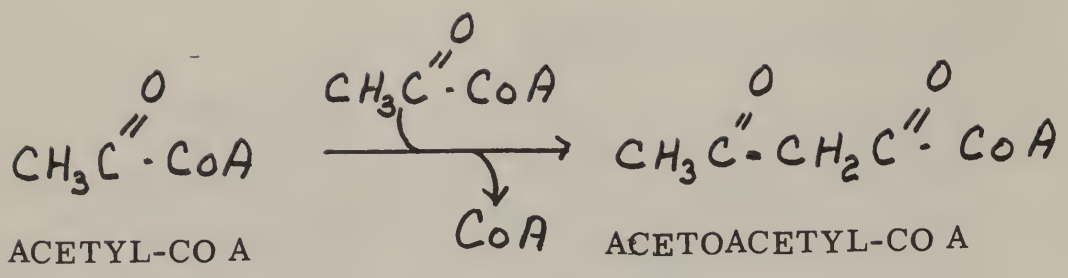
extra two nitrogen-containing rings are equivalent to the eight-carbon side chain of cholestanes. VERATRUM and its alkaloids are also composed of amine bases with a steroid structure.

Biosynthesis of Steroids

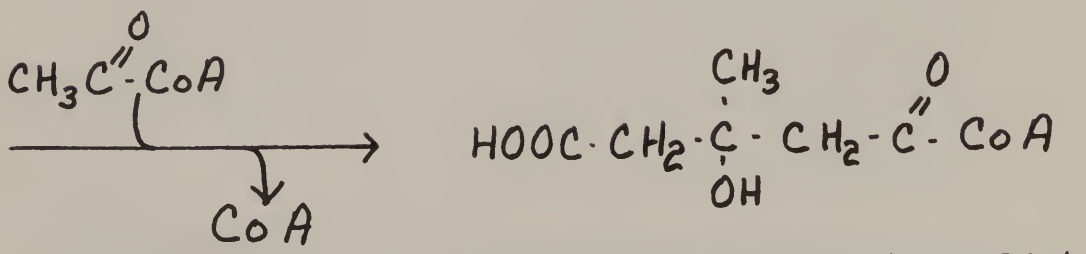
In man, nearly all steroids are synthesized by appropriate modifications of the cholesterol molecule. Thus the biosynthesis of cholesterol itself is the key to understanding the formation of all other steroid hormones. This pathway has been clarified as recently as the mid 1960's by studies carried out with bacterial, rat and human enzyme systems. The sequence of reactions as they are now understood will be reviewed, not so much for emphasis on the chemical steps involved, but as an illustration of the MeSH terms available to cover the various compounds involved.

As early as the 1930's it had been established that all the carbon atoms of cholesterol were derived from the two carbons of acetate. It is convenient to consider the sequence of this synthesis in three sections: (a) the conversion of acetate to a five-carbon unit; (b) the condensation of six of these units to the long chain compound, squalene; and (c) the cyclization of squalene to give a steroid which is converted eventually to cholesterol.

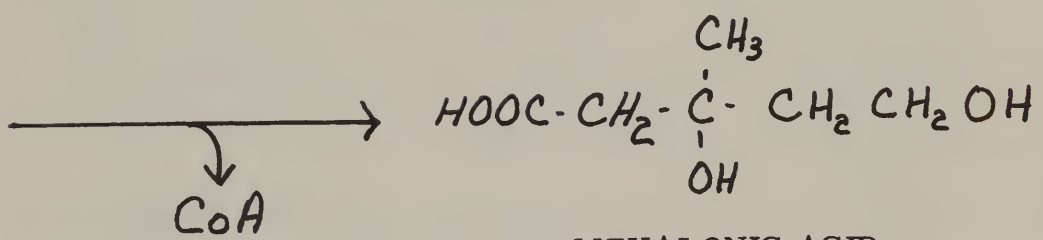
Acetate is started along the path to cholesterol (Figure 26) by conversion to acetyl-Co A, two molecules of which condense to form acetoacetyl-Co A. This condenses with a third molecule of acetyl-Co A to give hydroxymethylglutaryl-Co A. In several enzymatic steps, coenzyme A is released and hydroxymethylglutarate is reduced at the end of its chain which had been attached to Coenzyme A to form mevalonic acid. By reaction with adenosine triphosphate, liberation of the terminal carboxyl group as carbon dioxide, and loss of one molecule of water, the mevalonic acid is converted to isopentenyl pyrophosphate,



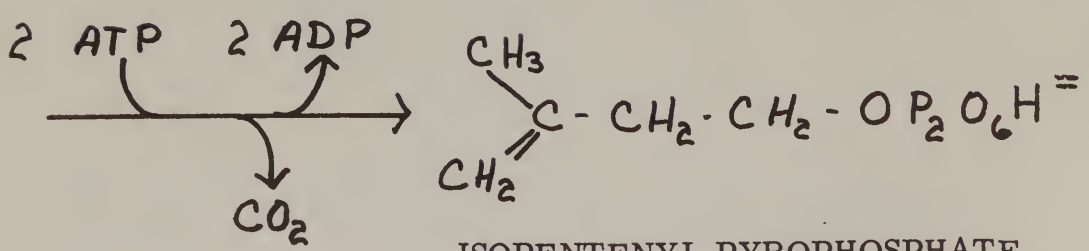
ACETYL-CO A ACETOACETYL-CO A



HYDROXYMETHYLGLUTARYL-CO A

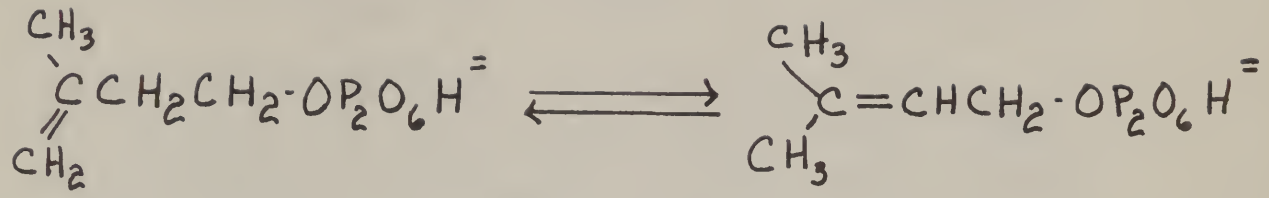


MEVALONIC ACID

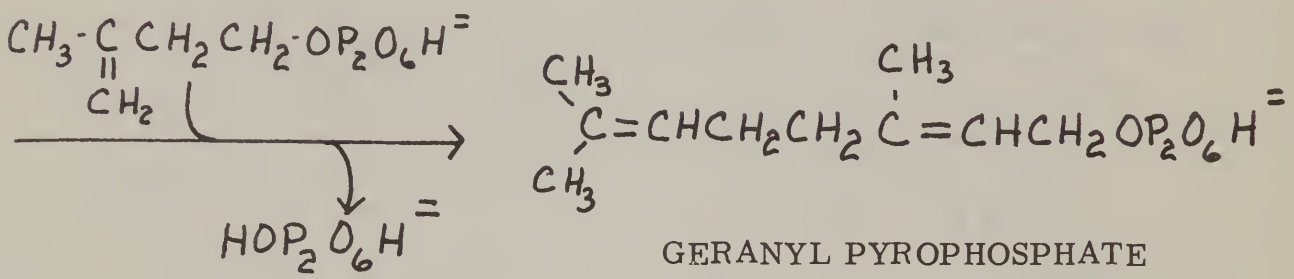


ISOPENTENYL PYROPHOSPHATE

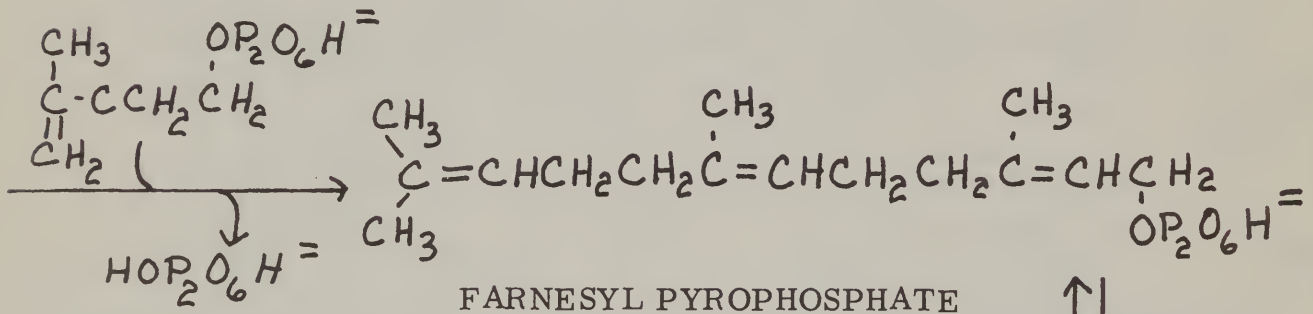
Figure 26



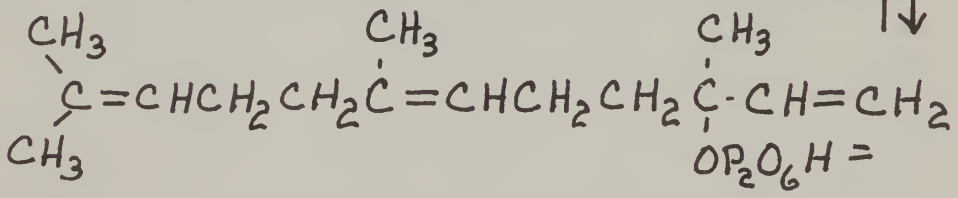
ISOPENTENYL PYROPHOSPHATE DIMETHYLALLYL PYROPHOSPHATE



GERANYL PYROPHOSPHATE



FARNESYL PYROPHOSPHATE



NEROLIDOL PYROPHOSPHATE

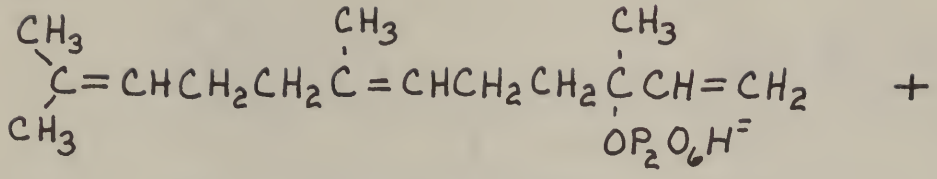
Figure 27

which serves as the building block for the next part of the biosynthetic sequence (Figure 27).

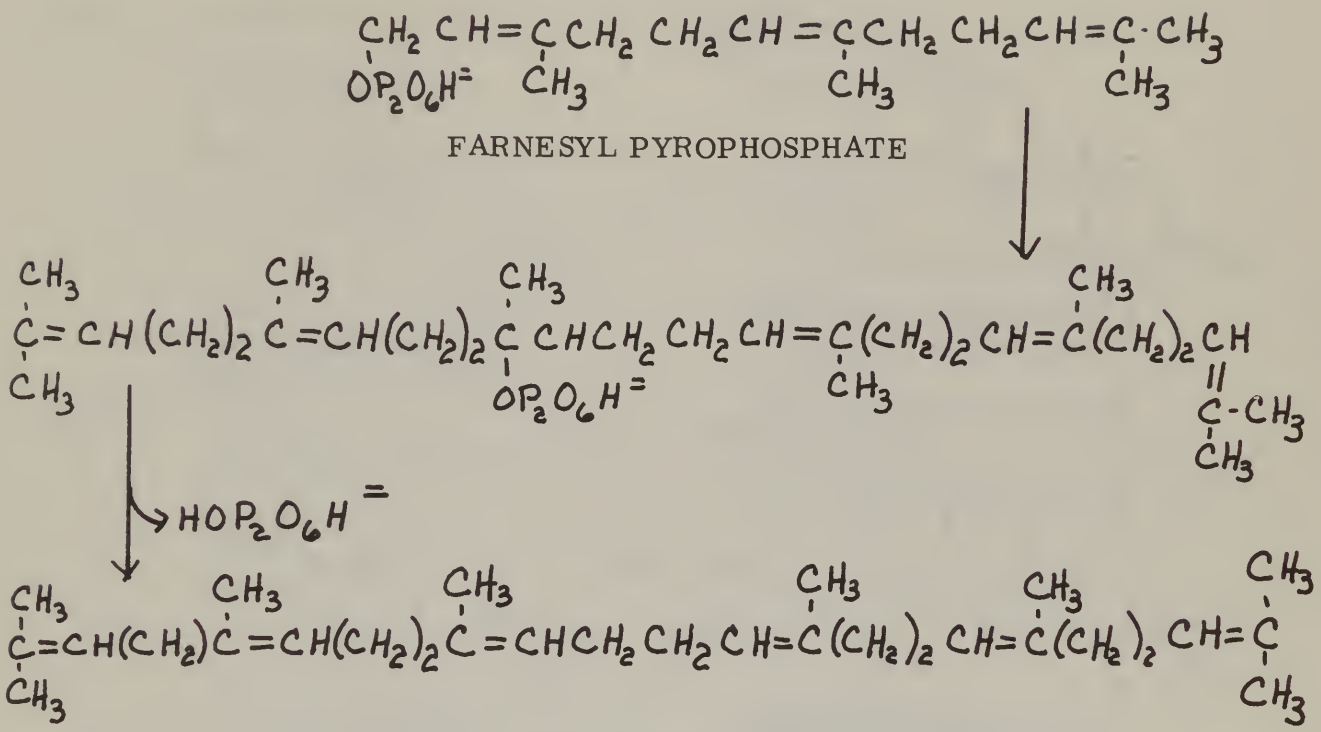
Isopentenyl pyrophosphate is converted to its stereoisomer, dimethylallyl pyrophosphate. One molecule of each of these compounds then condenses to give the terpene, geranyl pyrophosphate. This condenses with another molecule of isopentenyl pyrophosphate to give the 15-carbon unit, farnesyl pyrophosphate. Another stereoisomerization occurs (Figure 28), shifting the pyrophosphate group and forming nerolidol pyrophosphate. Condensation of farnesyl pyrophosphate and nerolidol pyrophosphate completes the assembly of the six isoprenoid units derived from isopentenyl pyrophosphate. With the loss of the remaining pyrophosphate group and shift of a double bond, squalene is formed.

The final pathway for the biosynthesis of cholesterol is shown in Figure 29. Squalene has been redrawn to show the folding pattern for steroid formation. The first step includes oxidation to introduce the hydroxyl group at C-3 of lanosterol. This is followed by another oxidation step, loss of two carbon atom side chains as carbon dioxide, and the ultimate reduction of desmosterol to cholesterol. The MeSH terms used to index the compounds involved in the biosynthesis of cholesterol are given in Table 2.

To summarize, all steroid compounds should be indexed under the most specific chemical terminology available, and under terms indicating the physiological or pharmacological role if it is of any significance in the article. The chemical terms include all those classes listed in category D2 under STEROIDS, that is, ANDROSTANES, BUFANOLIDES, CARDANOLIDES, CHOLANES, CHOLESTANES, CYCLOSTEROIDS, ESTRANES, FUROSTANS, GONANES, HOMOSTEROIDS, NORSTEROIDS, PREGNANES, SECOSTEROIDS and SPIROSTANS. Examination of the systematic name, which is frequently given in a footnote or in a



NEROLIDOL PYROPHOSPHATE



FARNESYL PYROPHOSPHATE

SQUALENE

Figure 28

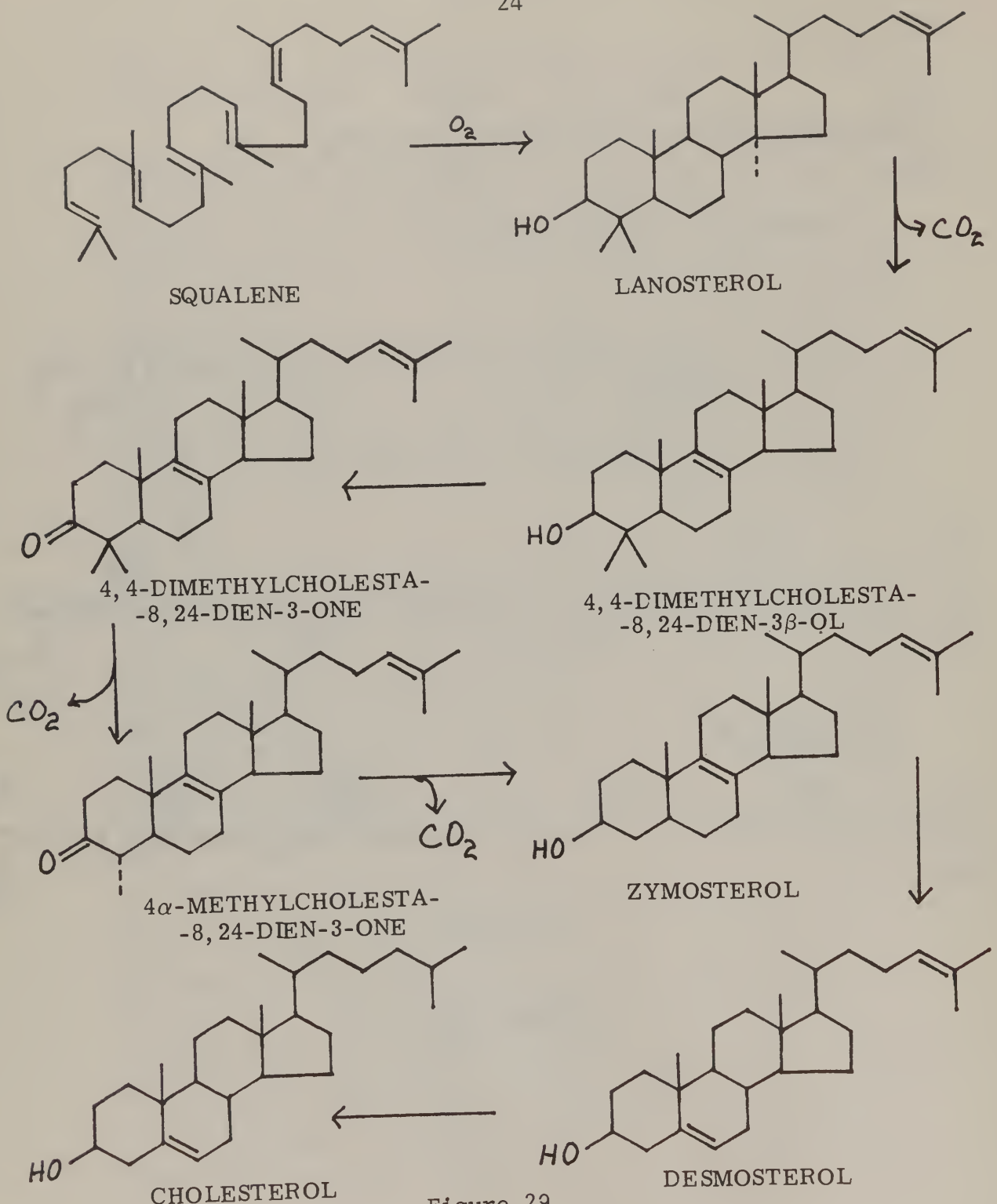

O2
HO
CO2
SQUALENE
LANOSTEROL
O
HO
4, 4-DIMETHYLCHOLESTA-
-8, 24-DIEN-3-ONE
4, 4-DIMETHYLCHOLESTA-
-8, 24-DIEN-3β-OL
CO2
O
CO2
HO
4α-METHYLCHOLESTA-
-8, 24-DIEN-3-ONE
ZYMOSTEROL
HO
HO
CHOLESTEROL
DESMOSTEROL

Figure 29

Table 2:

INTERMEDIATE	MESH TERMS TO BE USED
acetate	ACETATES
acetyl-Co A	COENZYME A
acetoacetyl-Co A	ACETOACETATES COENZYME A
hydroxymethylglutaryl-Co A	GLUTARATES COENZYME A
mevalonic acid	MEVALONIC ACID
isopentenyl pyrophosphate	ALKENES PYROPHOSPHORIC ACID
dimethylallyl pyrophosphate	ALKENES PYROPHOSPHORIC ACID
geranyl pyrophosphate	TERPENES PYROPHOSPHORIC ACID
farnesyl pyrophosphate	FARNESOL PYROPHOSPHORIC ACID
nerolidol pyrophosphate	TERPENES PYROPHOSPHORIC ACID
squalene	SQUALENE
lanosterol	CHOLESTANES STEROLS
4,4-dimethylcholesta- -8,24-dien-3 beta-ol	CHOLESTANES STEROLS
4,4-dimethylcholesta- -8,24-dien-3-one	CHOLESTANES
4 alpha-methylcholesta- -8,24-dien-3-one	CHOLESTANES
zymosterol	CHOLESTANES STEROLS
desmosterol	CHOLESTANES STEROLS
cholesterol	CHOLESTEROL

note in the references, will help to determine which class terms are to be used if the specific, or trivial, name is not a MeSH heading. In addition to the terms in D2, the general term STEROLS is listed in D11 and 17-HYDROXYCORTICOSTEROIDS and 17-KETOSTEROIDS from D8 should also be used as chemical descriptors. Many of the general terms are also represented by a number of specific compound names, which, of course, would be used preferentially as the indexing terms.

Terms denoting the physiological source of steroid hormones are listed in category D8, as well as those terms indicating the physiological and pharmacological roles of endogenous and exogenous compounds. Thus, there are ADRENAL CORTEX HORMONES, CORPUS LUTEUM HORMONES and PLACENTAL HORMONES; and these may be sub-divided into GLUCOCORTICOIDS, MINERALOCORTICOIDS, ESTROGENS, ANDROGENS, and, ANABOLIC STEROIDS.

Other steroid compounds are scattered throughout category D, according to their types of action. These include vitamin D, the bile acids and their derivatives and some alkaloids, as well as the antibiotic, fusidic acid; the diuretic, spironolactone; and the anesthetic, hydroxydione.

Examples of Steroid Indexing Using 1968 MeSH Terms

An article titled "Constituents of Convallaria. Structure of convallagenin A " which states that the compound in question is a spirostan, is indexed under CONVALLARIA, and under SPIROSTANS, both to appear in the printed Index Medicus.

An article discussing the glucocorticoid action of cortisol would be indexed under HYDROCORTISONE (IM) only, since the alphabetical MeSH listing

gives a cross reference from cortisol to the MeSH term HYDROCORTISONE, and in the categorized list D8 hydrocortisone is indented under glucocorticoids. It is therefore not necessary to use the term GLUCOCORTICOIDS, since HYDROCORTISONE is more specific.

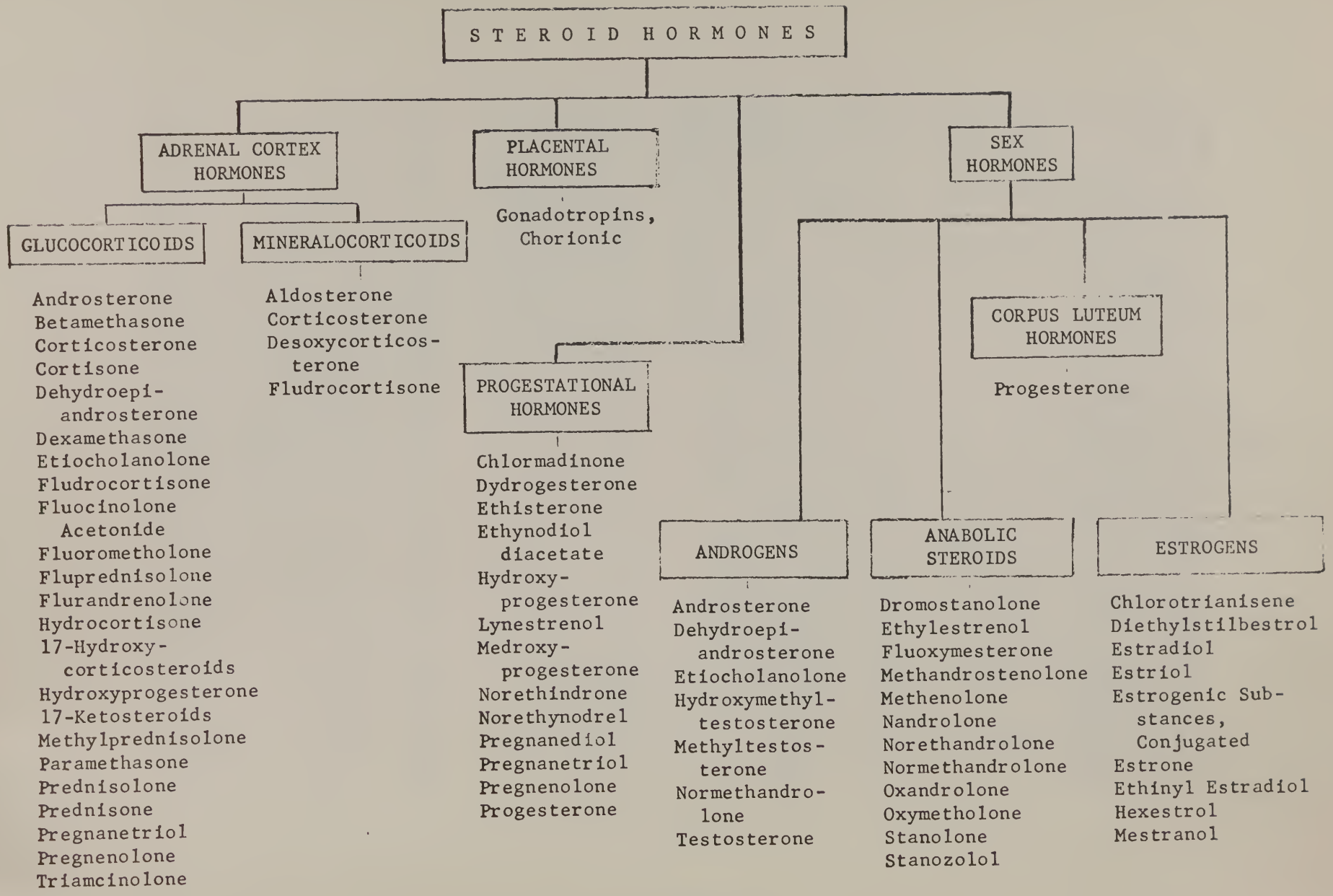

STEROID HORMONES
ADRENAL CORTEX HORMONES
PLACENTAL HORMONES
SEX HORMONES
GLUCOCORTICOIDS
MINERALOCORTICOIDS
Gonadotropins, Chorionic
Androsterone
Betamethasone
Corticosterone
Cortisone
Dehydroepi-androsterone
Dexamethasone
Etiocholanolone
Fludrocortisone
Fluocinolone Acetonide
Fluorometholone
Fluprednisolone
Flurandrenolone
Hydrocortisone
17-Hydroxy-corticosteroids
Hydroxyprogesterone
17-Ketosteroids
Methylprednisolone
Paramethasone
Prednisolone
Prednisone
Pregnanetriol
Pregnenolone
Triamcinolone
Aldosterone
Corticosterone
Desoxycorticos-terone
Fludrocortisone
PROGESTATIONAL HORMONES
CORPUS LUTEUM HORMONES
Progesterone
Chlormadinone
Dydrogesterone
Ethisterone
Ethynodiol diacetate
Hydroxy-progesterone
Lynestrenol
Medroxy-progesterone
Norethindrone
Norethynodrel
Pregnanediol
Pregnanetriol
Pregnenolone
Progesterone
ANDROGENS
ANABOLIC STEROIDS
ESTROGENS
Androsterone
Dehydroepi-androsterone
Etiocholanolone
Hydroxymethyl-testosterone
Methyltestos-terone
Normethandro-lone
Testosterone
Dromostanolone
Ethylestrenol
Fluoxymesterone
Methandrostenolone
Methenolone
Nandrolone
Norethandrolone
Normethandrolone
Oxandrolone
Oxymetholone
Stanolone
Stanozolol
Chlorotrianisene
Diethylstilbestrol
Estradiol
Estriol
Estrogenic Sub-stances, Conjugated
Estrone
Ethinyl Estradiol
Hexestrol
Mestranol

Figure 31

INDEXING INSTRUCTIONS FOR NON-MeSH TERMS

NON-MeSH TERMS	MeSH TERM TO BE USED
acetoacetyl-Co A	ACETOACETATES COENZYME A
acetyl-Co A	COENZYME A
adonitoxin	ADONIS
chenodesoxycholic acid	BILE ACIDS AND SALTS
cholic acid	BILE ACIDS AND SALTS
convallatoxin	CONVALLARIA
desmosterol	CHOLESTANES STEROLS
desoxycholic acid	BILE ACIDS AND SALTS
digitoxigenin	DIGITOXIN
digitoxose	HEXOSES
digoxigenin	DIGOXIN
dimethylallyl pyrophosphate	ALKENES PYROPHOSPHORIC ACIDS
4,4-dimethylcholesta-8,24-diene-3-one	CHOLESTANES
4,4-dimethylcholesta-8,24-dien-3β-ol	CHOLESTANES STEROLS
ergosterol	VITAMIN D
farnesyl pyrophosphate	FARNESOL PYROPHOSPHORIC ACIDS
geranyl pyrophosphate	TERPENES PYROPHOSPHORIC ACIDS
gitoxin	LANATOSIDES
glycocholic acid	BILE ACIDS AND SALTS
hydroxymethylglutaryl-Co A	GLUTARATES COENZYME A
isopentenyl pyrophosphate	ALKENES PYROPHOSPHORIC ACIDS
lanosterol	CHOLESTANES STEROLS
lily of the valley	CONVALLARIA
lithocholic acid	BILE ACIDS AND SALTS
4α-methylcholesta-8,24-diene-3-one	CHOLESTANES
nerolidol pyrophosphate	TERPENES PYROPHOSPHORIC ACIDS
oleandrin	OLEANDER
scillaren A	SQUILL
solanidine	SOLANINE
taurocholic acid	BILE ACIDS AND SALTS
zymosterol	CHOLESTANES STEROLS

ADONIS (B6, D5)
A genus of poisonous ranunculaceous plants, natives of Europe, Asia, and Africa. They produce a glycoside cardiac stimulant, adonitoxin.

ADRENAL CORTEX HORMONES (D8)
Syn. corticosteroids.
Steroid hormones, generally derivatives of the C-21 hydrocarbons (pregnanes) with a double bond at C-4 and keto groups at C-3 and C-20, which are produced by the adrenal cortex. They are mostly mineralocorticoids and glucocorticoids, but small amounts of androgens, estrogens and progesterone are produced here also.

allopregnandione
Reg. 566654
Syn. 5∝-pregnane-3,20-dione
Index PREGNANES (68)

17-amino derivative of progesterone
see 17-aminopregn-4-ene-3,20-dione

17-aminopregn-4-ene-3,20-dione
Syn. 17-amino derivative of progesterone.
Index PREGNANES (68)

ANABOLIC STEROIDS (D8)
Testosterone derivatives which tend to promote general body growth with little or no masculinizing effects.

anagestone acetate
Reg. 3137733
Syn. 17-hydroxy-6∝-methylpregn-4-en-20-one acetate
Index PREGNANES (IM)(68)
PROGESTATIONAL HORMONES (IM) (68)

ANDROGENS (D8)
Male sex hormones, substances capable of stimulating the development and functional activity of the male accessory structures and secondary sexual characteristics. Natural androgens in man are secreted by the testes, the adrenal cortex and the ovaries. The major androgen is testosterone.

androstane-3∝,17β-diol
Index ANDROSTANES (IM) (68)
STEROLS (NIM) (68)

5∝-androstane-3∝,17∝-diol
see 5β-androstane-3∝,17∝-diol

5β-androstane-3∝,17∝-diol
Syn. 5∝-androstane-3∝,17∝-diol.
The 5β isomer is isolated from normal human urine. The 5∝ isomer is a metabolite of testosterone by prostate.
Index ANDROSTANES (IM) (68)
STEROLS (NIM) (68)
17-HYDROXYCORTICOSTEROIDS (IM) (68)

androstane-3β-ol-17-one
see epiandrosterone

ANDROSTANES (D2) (68)
Steroids with methyl groups at C-10 and C-13 and with no more than one carbon at C-17. May include: Any degree of hydrogenation; Hetero substitution in any of the rings; Any non-carbon derivatives except as specified.

androstanolone
Reg. 521186
Syn. 17β-hydroxy-5∝-androstan-3-one
dihydrotestosterone
Index STANOLONE (68)

Δ^5-androstene-3β,17-diol
Reg. 521175
17α & 17β epimers are found in normal human urine.
Index ANDROSTANES (IM) (68)
STEROLS (NIM) (68)
17-HYDROXYCORTICOSTEROIDS (IM) (68)

androst-4-ene-6β,17β-diol-3-one
see 6β-hydroxytestosterone

3β-androsterone
see epiandrosterone

BILE ACIDS AND SALTS (D7)
Sterols from bile, including cholic acid, desoxycholic acid, chenodesoxycholic acid and lithocholic acid, which are frequently esterified with glycine or taurine. They aid in the hydrolysis of triglycerides by emulsification and solubilization of lipids. They will stimulate formation and release of bile by the liver.

brassicasterol
Syn. 24β-methyl-cholesta-5,22-dien-3β-ol
Found in steryl sulfates of human feces & in red algae.
Index STEROLS (IM) (68)
CHOLESTANES (IM) (68)

BUFANOLIDES (D2) (68)
Steroids with methyl groups at C-10 and C-13 and a six-membered lactone at C-17; includes epoxides. May include: Any degree of hydrogenation; Hetero substitution in any of the rings; any non-carbon derivatives and carbon derivatives except as specified.

campestanol
Syn. 24α-methyl-5α-cholest-3β-ol
Found in steryl sulfates of human feces.
Index STEROLS (IM) (68)
CHOLESTANES (IM) (68)

campesterol
Reg. 474624
Syn. Ergost-5-en-3β-ol,24 epimer; 24α-methyl-cholest-5-en-3β-ol
Found in steryl sulfates of human feces.
Index STEROLS (IM) (68)
CHOLESTANES (IM) (68)

CARDANOLIDES (D2) (68)
Steroids with methyl groups at C-10 and C-13 and a five-membered lactone at C-17; includes epoxides. May include: Any degree of hydrogenation; hetero substitution in any of the rings; any non-carbon derivatives and carbon derivatives except as specified.

CARDIAC GLYCOSIDES (D5, D11)
Plant derivatives in which a sugar side chain is linked to a sterol, specifically a cardanolide or bufanolike. They act to stimulate the action of heart muscle.

6-chloro-16-methylene-17α-acetoxypregna-4,6-diene-3,20-dione
Index PROGESTATIONAL HORMONES (IM) (68)
PREGNANES (IM) (68)

CHOLANES (D2) (68)
Steroids with methyl groups at C-10 and C-13 and a branched five-carbon chain at C-17. May include: Any degree of hydrogenation; hetero substitution in any of the rings; any con-carbon derivatives and carbon derivatives except as specified.

cholesta-8,24-diene-3β-ol
see zymosterol

cholesta-5,22-dien-3β-ol
see 22-dehydrocholesterol

5,24-cholestadien-3β-ol
see desmosterol

CHOLESTANES (D2) (68)
Steroids with methyl groups at C-10 and C-13 and a branched eight-carbon chain at C-17. May include: Any degree of hydrogenation; hetero substitution in any of the rings; any non-carbon derivatives and carbon derivatives except as specified.

5α-cholestan-3α-ol
see epicholestanol

cholest-5-en-3α-ol
see epicholesterol

5α-cholest-7-en-3β-ol
see lathosterol

CONVALLARIA (B6, D5)
Syn. lily of the valley.
Produces a cardiac glycoside, convallatoxin.

CORPUS LUTEUM HORMONES (D8)
Steroid hormones (progesterone and estrogens) secreted by the corpus luteum during the normal human menstrual cycle. If fertilization occurs, these hormones from the corpus luteum maintain gestation during the first trimester of pregnancy.

corticosteroids
Index ADRENAL CORTEX HORMONES (IM) (68)

CYCLOSTEROIDS (D2) (68)
Steroids containing a three-membered ring within the parent steroid.

22-dehydrocholesterol
Syn. cholesta-5,22-dien-3β-ol
Found in red algae.
Index STEROLS (IM) (68)
CHOLESTANES (IM) (68)

11-dehydrocorticosterone
Reg. 72231
Syn. 21-hydroxypregn-4-ene-3,11,20-trione
Index PREGNANES (68)

21-dehydrocortisol
Syn. 4-pregnene-11β,17α-diol-3,20-dione-21-al
Index PREGNANES (IM) (68)
17-HYDROXYCORTICOSTEROIDS (IM) (68)
STEROLS (NIM) (68)

DEHYDROEPIANDROSTERONE (D2, D8)
Reg. 53430
Syn. dehydroisoandrosterone; 3β-hydroxy-5-androsten-17-one

dehydroisoandrosterone
see DEHYDROEPIANDROSTERONE

desmosterol
Reg. 313042
Syn. 5,24-cholestadien-3β-ol
A major sterol of red algae.
Immediate precursor of cholesterol in the biosynthetic pathway.
Index STEROLS (IM) (68)
CHOLESTANES (IM) (68)

DIGITALIS GLYCOSIDES (D5)
Derivatives of plants of the foxglove family, sterols (cardanolides) with from one to four sugars in glycoside linkage with a hydroxyl group at C-3 of the steroid nucleus. They act to stimulate the heart muscle directly.

DIGITOXIN (D2, D5)
A cardiotonic glycoside obtained from Digitalis purpurea and D. lanata. Its aglycone is digitoxigenin.

DIGOXIN (D2, D5)
A cardiotonic glycoside obtained from the leaves of Digitalis lanata. Lanatoside A is digitoxin, lanatoside B is gitoxin, lanatoside C is digoxin.

dihydrotestosterone
see STANOLONE

3α,11β-dihydroxy-5β-androstan-17-one
see 11β-hydroxyetiocholanolone

epiandrosterone
Reg. 438233 (5β); 481298 (3β)
Syn. 3β-androsterone; isoandrosterone; 3β-hydroxy-5α-androstan-17-one; androstane-3β-ol-17-one
Naturally occurring androgen in man.
Index ANDROSTERONE (68)

epicholestanol
Reg. 516950
Syn. 5α-cholestan-3α-ol
Index STEROLS (IM) (68)
CHOLESTANES (IM) (68)

epicholesterol
Reg. 474771
Syn. cholest-5-en-3∝-ol
Index CHOLESTEROL (68)

16-epistriol
Syn. estra-1,3,5(10)-triene-3,16β, 17β-triol
A urinary metabolite of estriol.
Index ESTRIOL (68)

equilenin
Reg. 517099
Syn. 1,3,5(10),6,8-estrapentaen-3-ol-17-one
Index 17-KETOSTEROIDS (IM) (68)
ESTRANES (IM) (68)

equilin
Reg. 474862
Syn. 1,3,5,7-estratetraen-3-ol-17-one
Index 17-KETOSTEROIDS (IM) (68)
ESTRANES (IM) (68)

ergosta-5,24(28)-diene-3β-ol
see 24-methylenecholesterol

ergost-5-en-3β-ol,24 epimer
see campesterol

ESTRANES (D2) (68)
Steroids with methyl groups at C-13, with no carbon at C-10 and with no more than one carbon at C-17. May include: any degree of hydrogenation; hetero substitution in any of the rings; any non-carbon derivatives and carbon derivatives except as specified.

1,3,5(10),6,8-estrapentaen-3-ol-17-one
see equilenin

1,3,5,7-estratetraen-3-ol-17-one
see equilin

estra-1,3,5(10)-triene-3β,17β-diol-16-one
see 16-ketoestradiol

estra-1,3,5(10)-triene-3,16β,17β-triol
see 16-epistriol

ESTROGENS (D8)
Female sex hormones, substances capable of stimulating the development and maintenance of the morphological and functional state of the female reproductory system and secondary sexual characteristics. Involved in the production of estrus in sub-primate mammals, and in ovulation, implantation, pregnancy, parturition and lactation for all mammals. The principal sources in man are the ovaries and placenta, small amounts are produced by the adrenal cortex and testes. The major estrogens are estradiol, estrone and estriol.

17∝-ethinyl-4-estrene-3β,17β-diol acetate
Antispermatogenic agents in rat
Index CONTRACEPTIVE AGENTS (IM) (68)
ESTRANES (IM) (68)
STEROLS (NIM) (68)

24∝-ethylcholesta-5,22-dien-3β-ol
see stigmasterol

24∝-ethyl-5∝-cholestan-3β-ol
see β-sitostanol

24-ethylidene-cholest-5-en-3β-ol
see fucosterol

fucosterol
Reg. 481141
Syn. 24-ethylidene-cholest-5-en-3β-ol
Found in steryl sulfate fraction of human feces & in red algae.
Index STEROLS (IM) (68)
CHOLESTANES (IM) (68)

FUROSTANS (D2) (68)
Steroids with the following structure which may include: any degree of hydrogenation; hetero substitution in any of the rings; any non-carbon derivatives and carbon derivatives except as specified.

GLUCOCORTICOIDS (D8) (67)
Adrenal cortex hormones, members of the 11,17-oxysteroid series, which regulate carbohydrate metabolism, promoting gluconeogenesis, hyperglycemia, glycosuria, etc.; therapeutically they are used as anti-inflammatory agents.

GONANES (D2) (68)
The parent class of steroids, without methyl groups at C-10 or C-13 and with no more than one carbon at C-17. May include: any degree of hydrogenation; hetero substitution in any of the rings; any non-carbon derivatives and carbon derivatives except as specified.

HOMOSTEROIDS (D2) (68)
Steroids containing any ring enlargement within a parent steroid.

3β-hydroxy-5α-androstan-17-one
see epiandrosterone

17β-hydroxy-5α-androstan-3-one
dihydrotestosterone
see androstanolone

3β-hydroxy-5-androsten-17-one
see DEHYDROEPIANDROSTERONE

17-HYDROXYCORTICOSTEROIDS (D8) (68)
Adrenocortical hormones having a hydroxyl group at the 17 position, such as 11-dehydro-17-hydroxycorticosterone (cortisone); 11-deoxy-17-hydroxycorticosterone; 17-hydroxycorticosterone (hydrocortisone); the major metabolic pathway of progesterone in man involves 17-hydroxylation to 17-hydroxyprogesterone, then further transformation to 17-hydroxycorticosterone. Their presence in the urine is often measured as an indication of various disease states.

11β-hydroxyetiocholanolone
Syn. 3α,11β-dihydroxy-5β-androstan-17-one
Index ANDROSTANES (IM) (68)
17-KETOSTEROIDS (IM) (68)
STEROLS (IM) (68)

17-hydroxy-6α-methylpregn-4-en-20-one acetate
see anagestone acetate

21-hydroxypregn-4-ene-3,11,20-trione
see 11-dehydrocorticosterone

20(αorβ)-hydroxy-4-pregnen-3-one
Index PREGNANES (IM) (68)
STEROLS (IM) (68)

6β-hydroxytestosterone
Syn. androst-4-ene-6β,17β-diol-3-one
Excretory product of testosterone in adults & fetus.
Index ANDROSTANES (IM) (68)
17-HYDROXYCORTICOSTEROIDS (IM) (68)
STEROLS (NIM) (68)

1β-hydroxytetrahydrocortisone
Syn. 1β,3α,17α,21-tetrahydroxy-5β-pregnane-11,20-diene
Index PREGNANES (IM) (68)
STEROLS (NIM) (68)
17-HYDROXYCORTICOSTEROIDS (IM) (68)

isoandrosterone
see epiandrosterone

16-ketoestradiol
Syn. estra-1,3,5(10)-triene-3β,17β-diol-16-one
A urinary metabolite of estriol
Index ESTRANES (IM) (68)
17-HYDROXYCORTICOSTEROIDS (IM) (68)
STEROLS (NIM) (68)

17-KETOSTEROIDS (D8)
Any steroid with a ketone group at C-17. Generally metabolites of adrenal and testicular androgens. Urinary 17-ketosteroids are used as a measure of adrenal androgen production by females, in males two-thirds of the 17-ketosteroids are of adrenal origin, one-third are from the testes.

LANATOSIDES (D5)
Glycosides obtained from the leaves of Digitalis lanata. Lanatoside A is digitoxin, lanatoside B is gitoxin, lanatoside C is digoxin.

lanosterol
Reg. 79630
Syn. 4,4,13-trimethylcholest-8,24-dien-3β-ol
1st step in the synthesis of cholesterol from squalene.
Index CHOLESTANES (IM) (68)
STEROLS (IM) (68)

lathosterol
Syn. 5∝-cholest-7-en-3β-ol
Found in steryl sulfates of human feces.
Index STEROLS (IM) (68)
CHOLESTANES (IM) (68)

2-methoxyestrone
Reg. 362083
Syn. 2-methoxy-3-hydroxy-1,3,5(10)-estratriene-17-one
A metabolite of estrone in the rat.
Index ESTRANES (IM) (68)
STEROLS (IM) (68)
17-KETOSTEROIDS (IM) (68)

2-methoxy-3-hydroxy-1,3,5(10)-estratriene-17-one
see 2-methoxyestrone

24β-methyl-cholesta-5,22-dien-3β-ol
see brassicasterol

24∝-methyl-cholest-5-en-3β-ol
see campesterol

24∝-methyl-5∝-cholest-3β-ol
see campestanol

16-methylene-17∝-acetoxypregna-4,6-diene-3,20-dione
Index PROGESTATIONAL HORMONES (IM) (68)
PREGNANES (IM) (68)
STEROLS (NIM) (68)

24-methylenecholesterol
Syn. ergosta-5,24(28)-diene-3β-ol
Found in red algae.
Index STEROLS (IM) (68)
CHOLESTANES (IM) (68)

MINERALOCORTICOIDS (D8) (68)
Adrenal cortex hormones, generally members of the 11-desoxysteroid series, which regulate electrolyte and water balance in the organism. The distinction between MINERALOCORTICOIDS and GLUCOCORTICOIDS is made on physiological, rather than chemical, basis, inasmuch as certain 11, 17-oxysteroids have intense mineralocorticoid activity (e.g., fludrocortisone)

NORSTEROIDS (D2) (68)
Steroids containing any ring contraction within a parent steroid.

OLEANDER (B6, D5)
An evergreen shrub producing the cardiac glycoside, oleandrin.

OUABAIN (D2, D2)
Reg. 36066
A glycoside obtained from the seeds of Strophanthus gratus, used as a cardiotonic.

PLACENTAL HORMONES (D8)
Chorionic gonadotropins, progesterone and estrogens. They are responsible for maintaining gestation during the last two trimesters of pregnancy.

5β-pregnane-3∝,20∝-diol
Reg. 80922
Index PREGNANES (IM) (68)
STEROLS (IM) (68)

5∝-pregnane-3,20-dione
see allopregnandione

5β-pregnane-3,20-dione
Reg. 128234
Index PREGNANES (68)

PREGNANES (D2) (68)
Steroids with methyl groups at C-10 and C-13 and a two-carbon chain at C-17. May include: any degree of hydrogenation; hetero substitution in any of the rings; any non-carbon derivatives and carbon derivatives except as specified.

4-pregnene-11β,17∝-diol-3,20-dione-21-al
see 21-dehydrocortisol

PROGESTATIONAL HORMONES (D8)
Syn. progestins.
Substances having progesterone-like action in maintenance of pregnancy and preparation of the mammary glands for lactation. Secreted by the adrenal cortex, the corpus luteum and the placenta.

SAPONINS (D11)
Glycosides from plants which form a durable foam when their watery solutions are shaken; can dissolve red blood cells even in high dilutions.

SECOSTEROIDS (D2) (68)
Steroids containing any ring fission within a parent steroid.

SEX HORMONES (D8)
Substances influencing the development and function of sexual organs and secondary sexual characteristics of the male and female. In the male, these are androgens, in the female, estrogens and progesterone.

β-sitostanol
Reg. 83454
Syn. 24α-ethyl-5α-cholestan-3β-ol
Found in steryl sulfates of human feces.
Index CHOLESTANES (IM) (68)
STEROLS (IM) (68)

SOLANINE (D2, D11)
A glycoside from members of the nightshade family, especially potatoes and tomatoes. The aglycone is solanidine.

SPIROSTANS (D2) (68)
Steroids with the following structure which may include: any degree of hydrogenation; hetero substitution in any of the rings; Any non-carbon derivatives and carbon derivatives except as specified.

STANOLONE (68)
Reg. 521186
Syn. dihydrotestosterone

SQUILL (B6, D5)
A Mediterranean bulbus herb of the lily family, which produces a cardiac glycoside, scillaren A.

STEROIDS (D2)
Compounds containing a cyclopentanoperhydrophenanthrene ring system.

STEROLS (D11)
A steroid alcohol.

stigmasterol
Reg. 83487
Syn. 24α-ethylcholesta-5,22-dien-3β-ol
Found in steryl sulfates of human feces & in red algae.
Index CHOLESTANES (IM) (68)
STEROLS (IM) (68)

STROPHANTHIN (D2, D5)
Reg. 560532
A plant glycoside from African members of the dogbane family.

1β,3α,17α,21-tetrahydroxy-5β-pregnane-11,20-diene
see 1β-hydroxytetrahydrocortisone

4,4,13-trimethylcholest-8,24-dien-3β-ol
see lanosterol

VERATRUM (B6, D2, D5)
A genus of coarse herbs of the lily family, and the alkaloids derived from them. They are chiefly amine bases of steroid structure and act as antihypertensive agents.

VITAMIN D (D11)
Any one of several related sterols with antirachitic properties. They are produced artificially by irradiation of ergosterol, and are produced in the body on exposure to sunlight.

zymosterol
Syn. cholesta-8,24-diene-3β-ol
Index CHOLESTANES (IM) (68)
STEROLS (IM) (68)

U.S. Department of Health, Education, and Welfare

NATIONAL INSTITUTES OF HEALTH

APR 7 1969